

# **Using Water Quality, Stable Isotopes, and SPMDs to Determine Human Disturbance Gradients in the Truckee River**

Michael Rosen, USGS

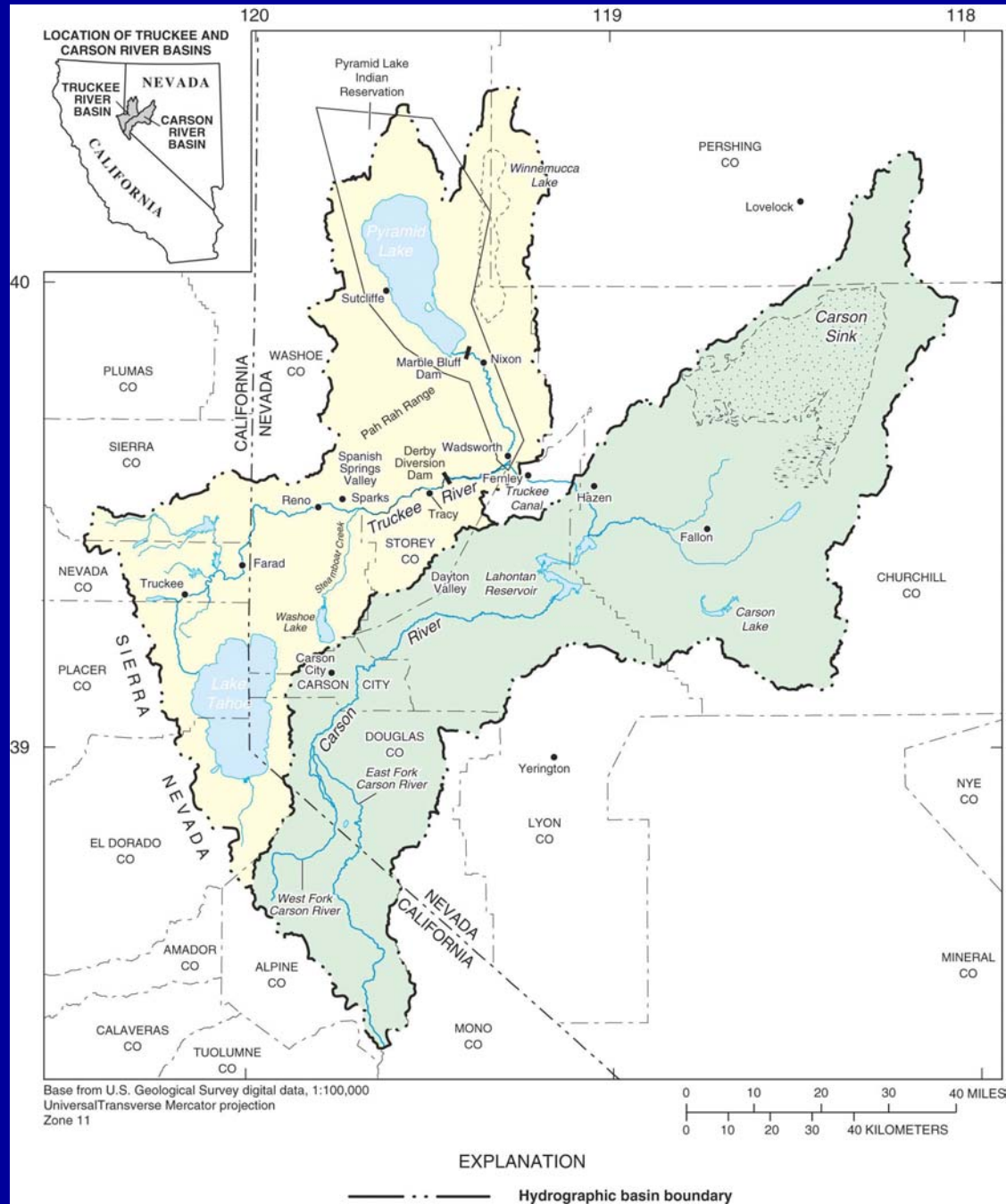
Laurel Saito, Univ. of Nevada Reno

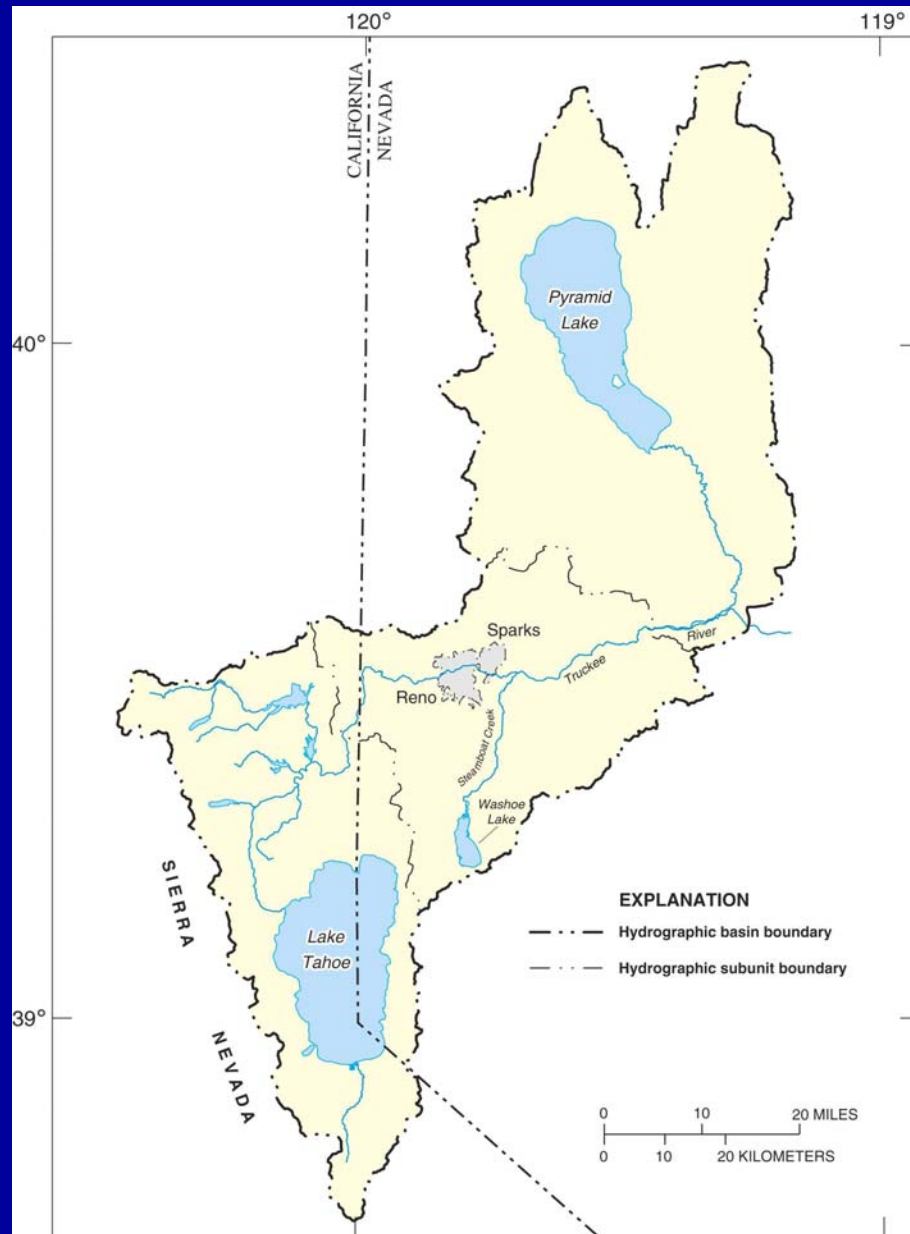
Timothy Rowe, USGS

Dan Mosley, Pyramid Lake Paiute Tribe

# Presentation outline

- Review of Truckee River issues
- Recent activities
- Implications
- Where do we go from here?
  - Channel restoration
  - Bioassessment criteria
  - Collaborations
  - Other projects/proposals





Base from U.S. Geological Survey digital data, 1:100,000, 1979-80  
Universal Transverse Mercator projection, Zone 11

Truckee River Basin, California and Nevada.

# Truckee River issues

- Urbanization
- Sewage discharges
- Highly regulated
- Endangered fish
- Water quantity (low flows)

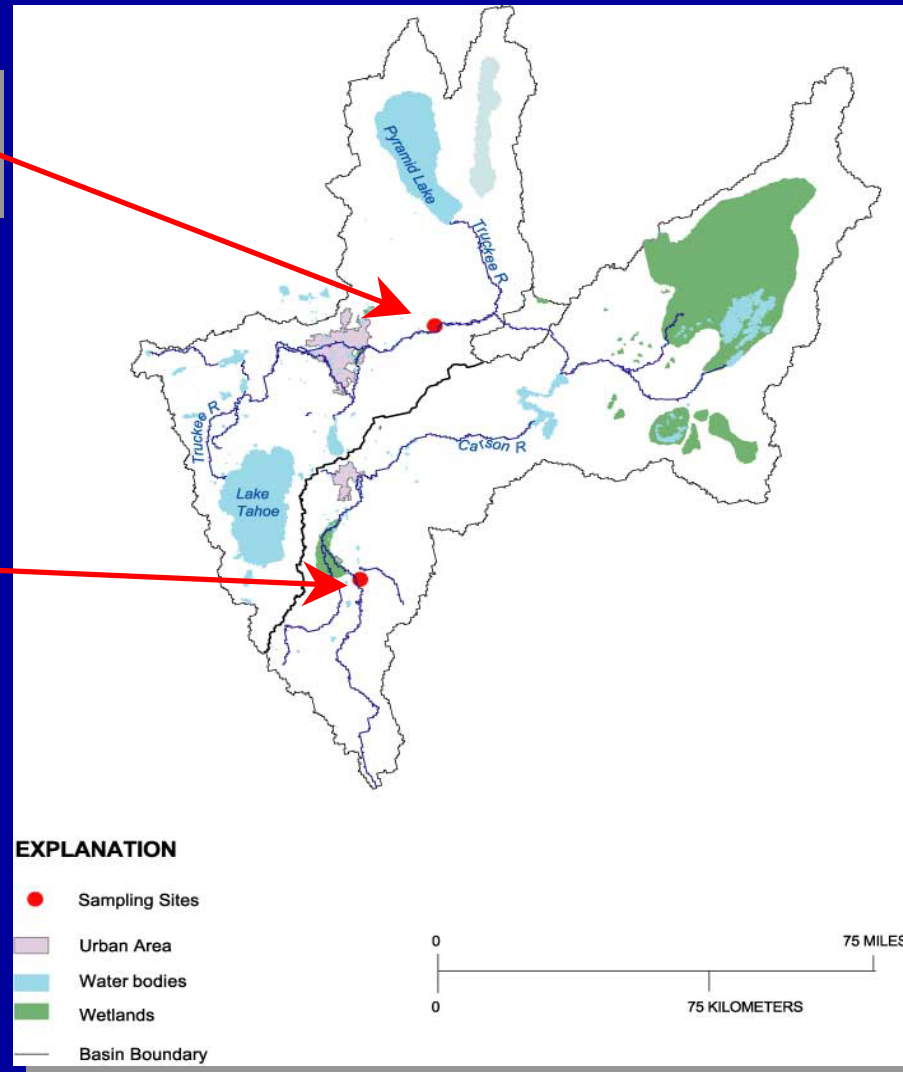
# Recent activities by USGS

- Trend site monitoring
- Multiple reach sampling
- Continuous monitoring
- SPMDs
- Mercury synoptic sampling

# Trend site monitoring

Clark  
“integrator site”

Dresslerville  
“reference site”



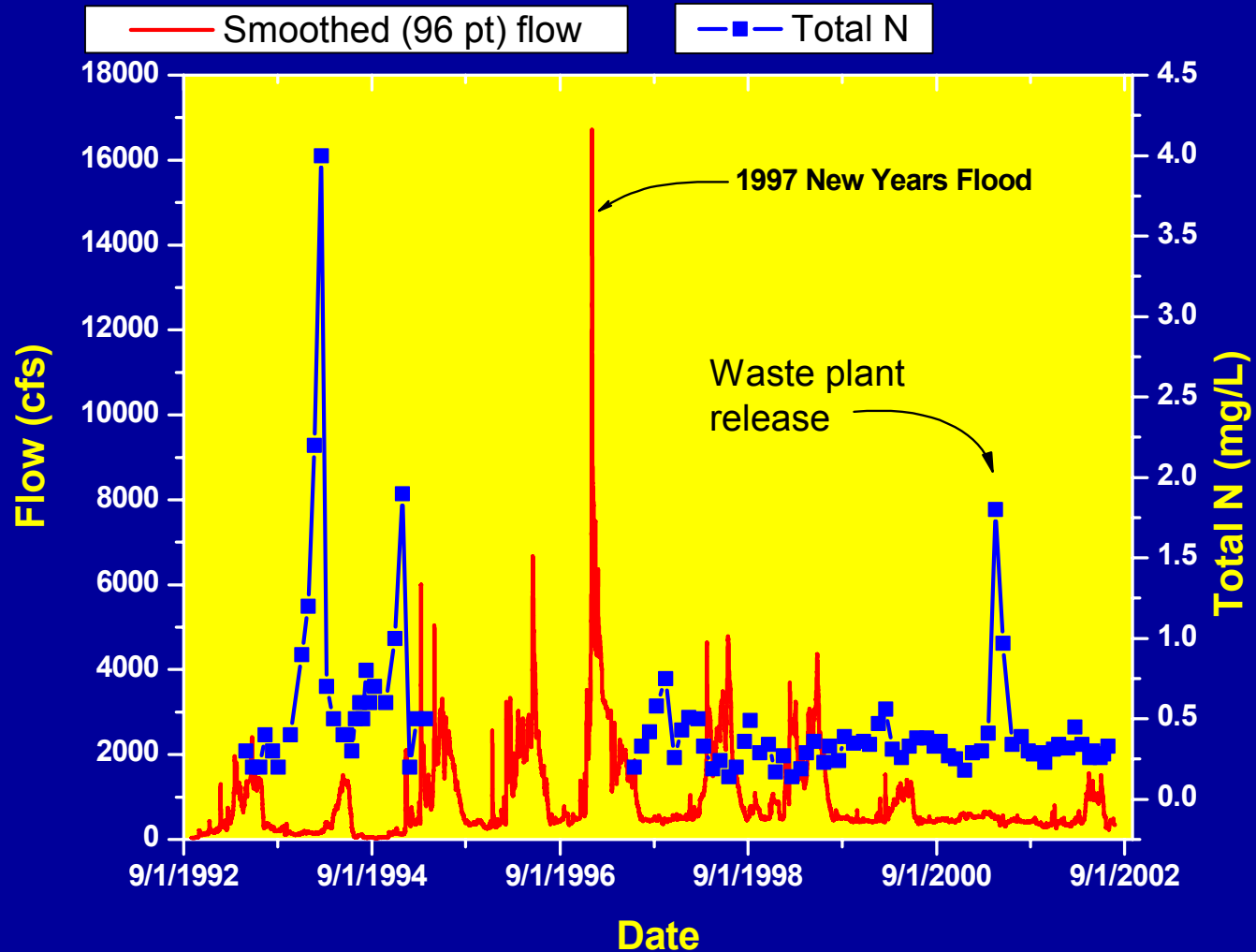
# Trend site monitoring

- Sampling for
  - Temperature
  - Dissolved oxygen
  - pH
  - Alkalinity
  - Specific conductance
  - Chloride and sulfate
  - Nutrients
  - Dissolved organic carbon
  - Total particulate carbon and nitrogen
  - Pesticides

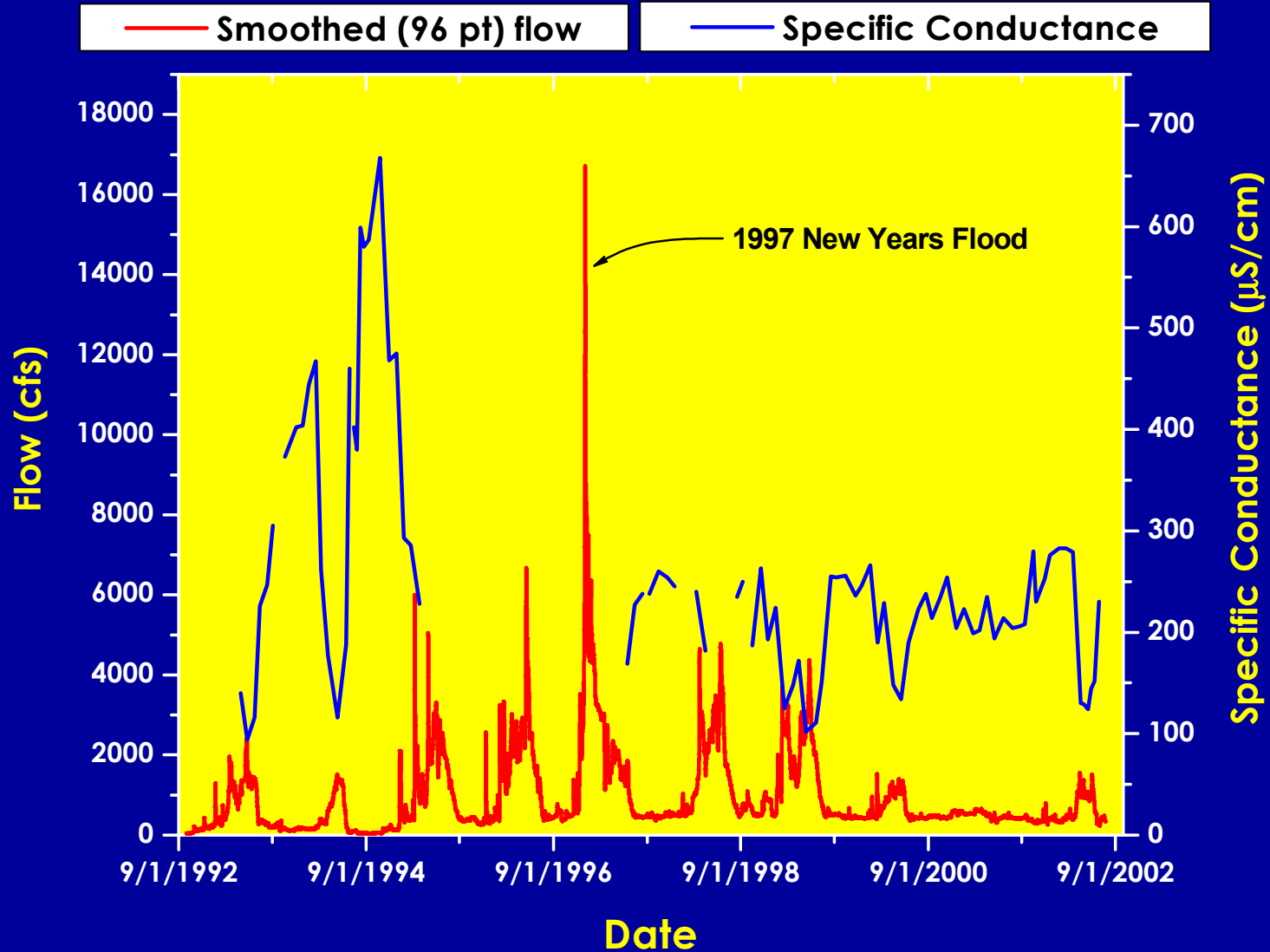




# Long-term trend monitoring at Clark



# Continuous sampling



# Multiple reach sampling



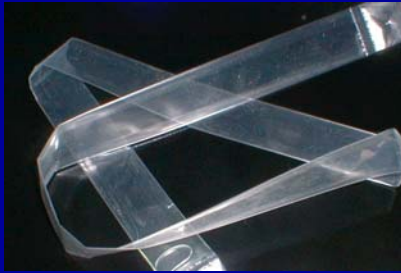
Dresslerville, Carson River



Clark, Truckee River

# Multiple reach sampling





# SPMDs

Q: What is a SPMD ?

A: **S**emi-**P**ermeable **M**embrane **D**evice

Q: Composition ?

A: Low density polyethylene layflat tubing containing lipid (fat-like organic compound made of triolein)

Q: Mode of Action ?

A: Passive and Ametabolic (no change)

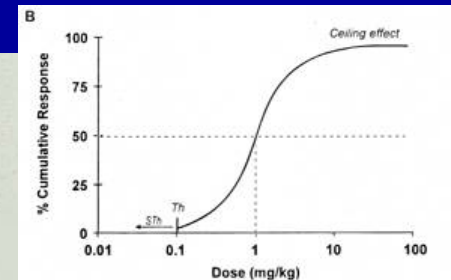
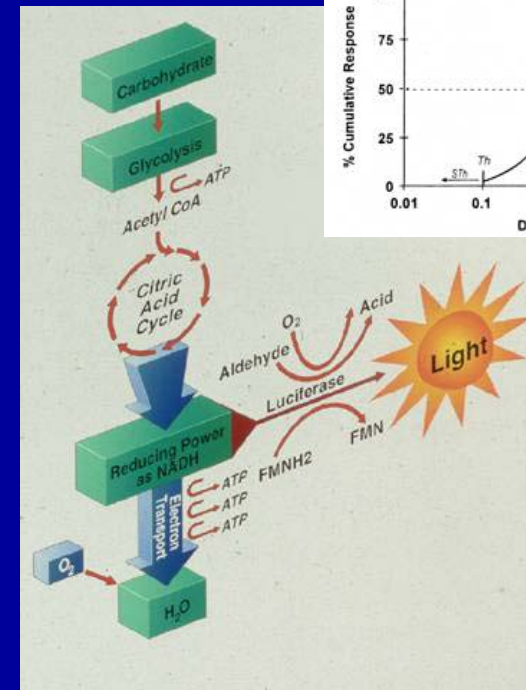
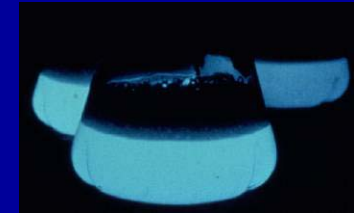
# SPMDs for aquatic risk assessment

- The issue
  - Toxicological risk assessment of water-borne toxins
- The problem
  - Toxicological identification of bioavailable water-borne toxins
- The approach
  - Collection by passive sorptive devices and detection by microscale toxicity tests



# SPMDs for aquatic risk assessment

- The method: SPMD-TOX
  - To collect and concentrate lipophilic chemicals
  - Concentration of lipophilic chemicals is similar to mechanism of bioaccumulation of toxins in fish



# SPMDs for aquatic risk assessment

- Types of compounds detected
  - PAHs
  - Fuel compounds (MTBE, BTEX, etc.)
  - PCBs
  - Organochlorine pesticides
  - Other hydrophilics (low solubility in water)



# SPMDs for aquatic risk assessment

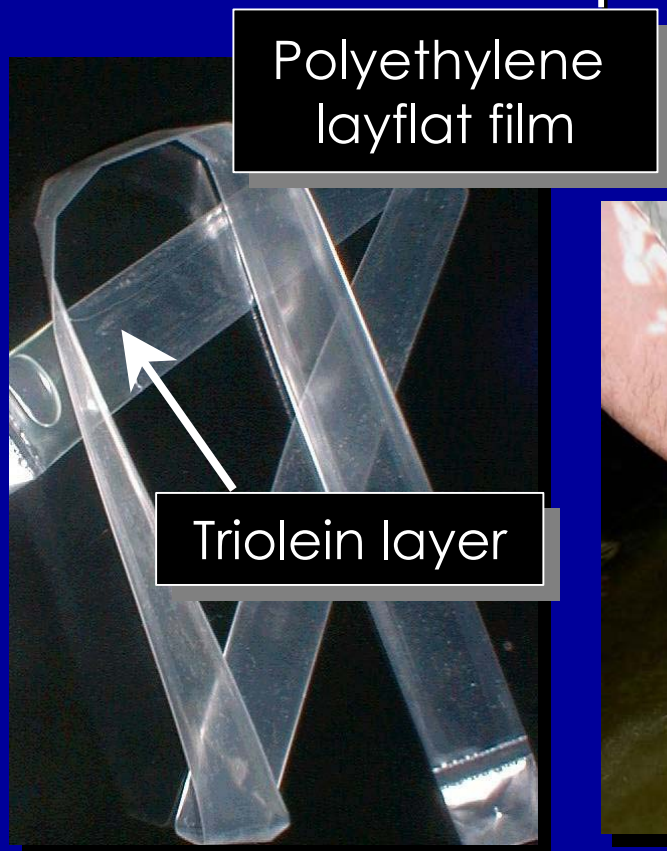
- Where can SPMD-TOX devices be deployed?
  - Rivers, streams, lakes, reservoirs, groundwater, atmosphere
    - Requires 2-5 L/day of water to pass by device
    - Usually deployed for 4-6 weeks
    - Must be secure from vandalism
    - Must be placed in at least 15 cm of water



Mini SPMD

# SPMDs for aquatic risk assessment

- SPMD field deployment



SPMD with protective covering





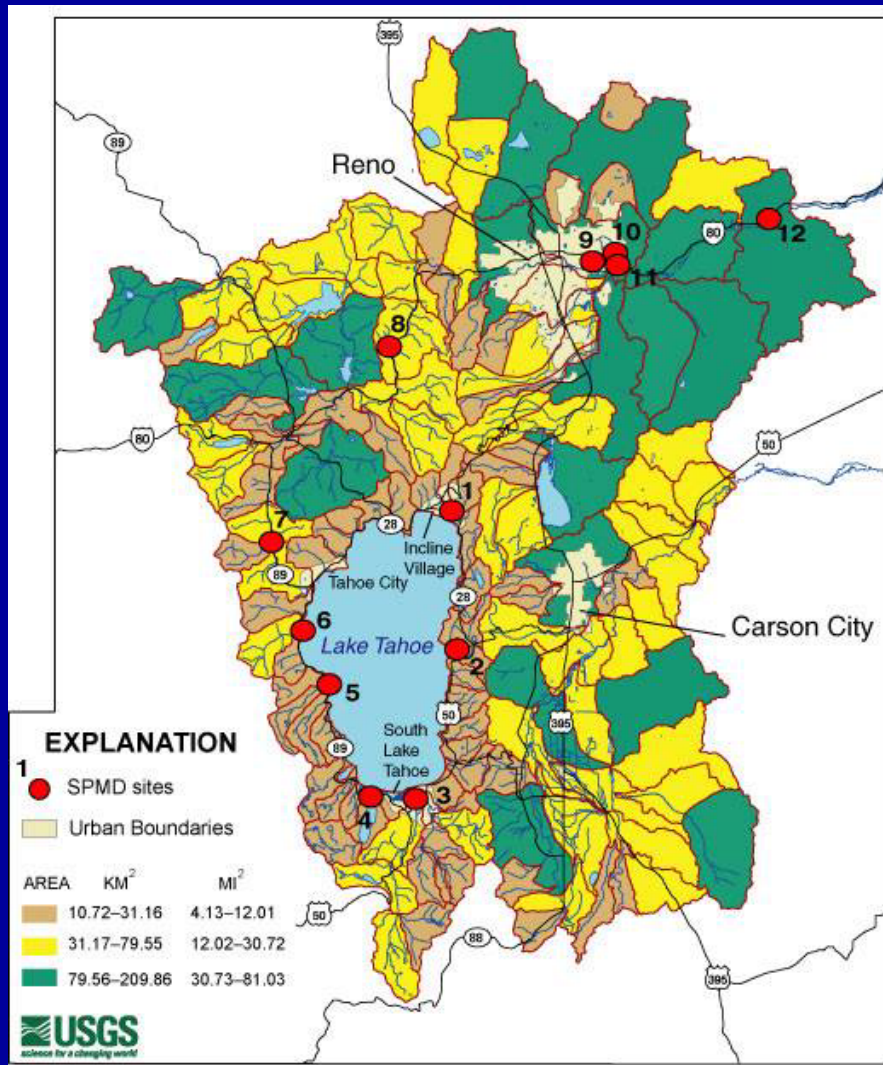
# SPMD deployment in Nevada



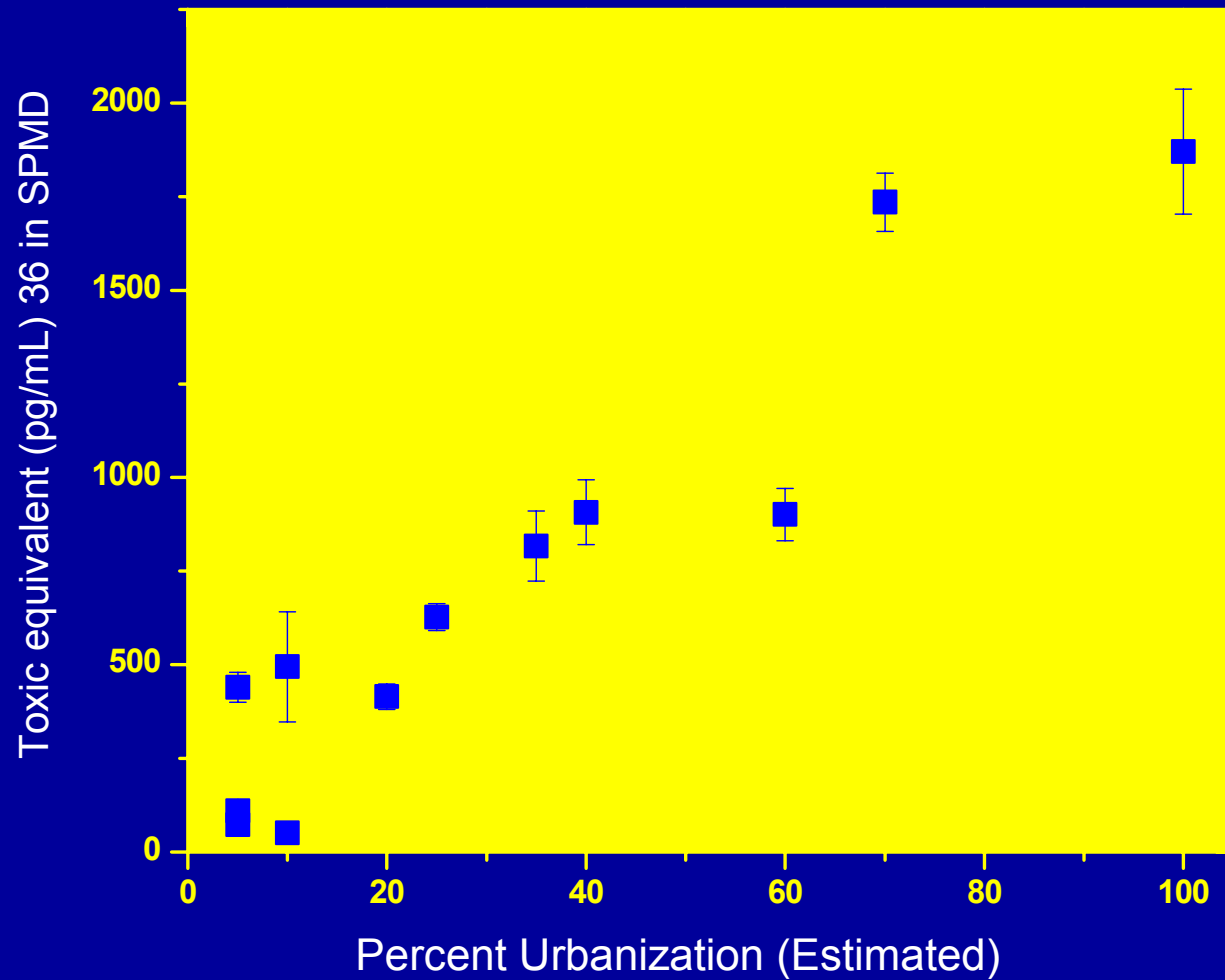
# SPMD deployment in Nevada

SPMD sites deployed:  
August 5-6, 2002

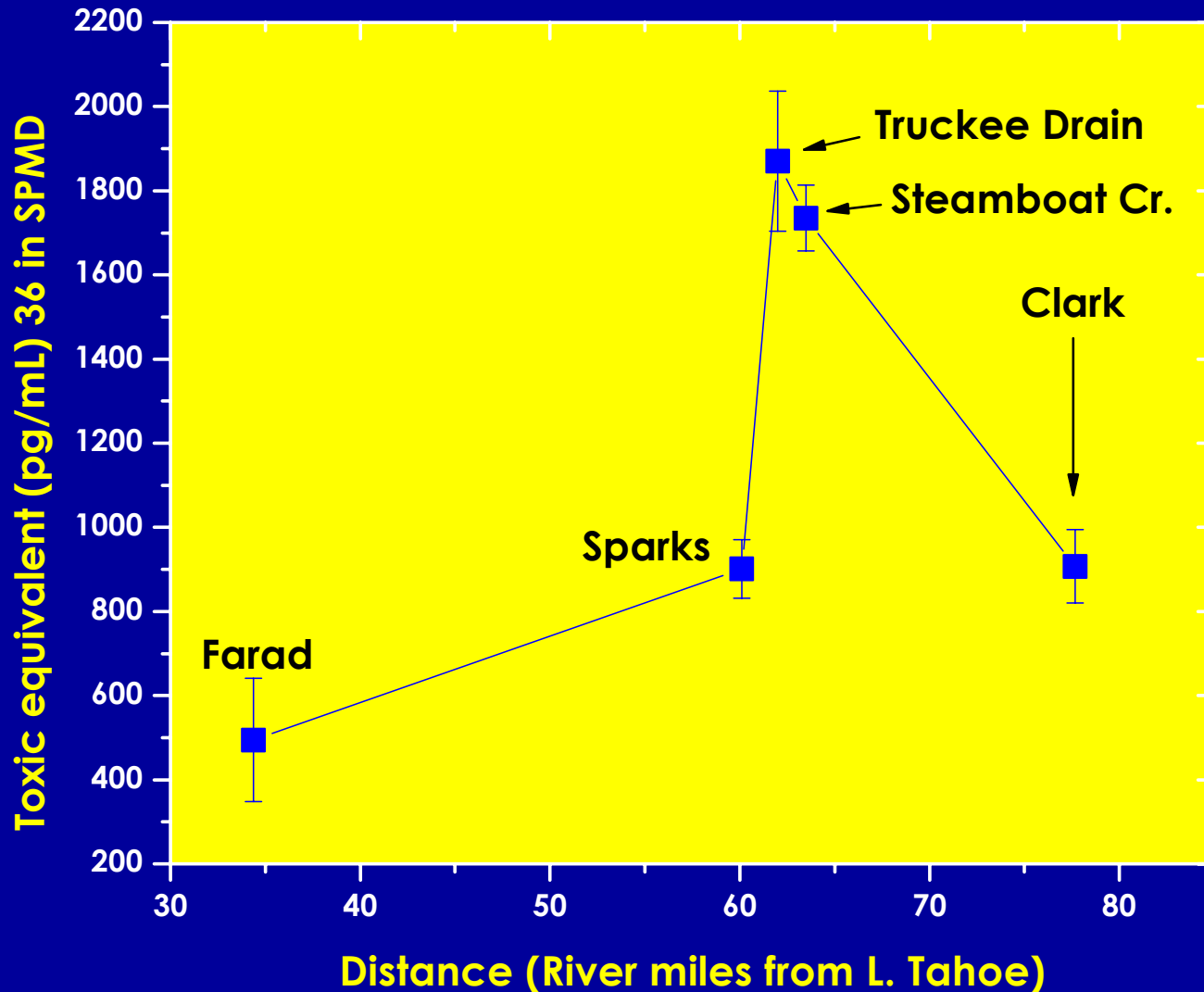
Retrieved:  
September 5-6, 2002



# SPMD results

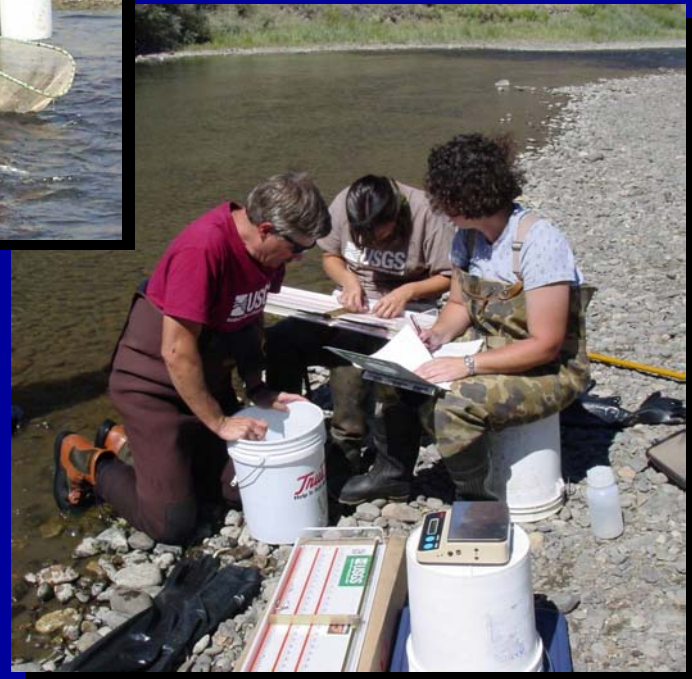


# SPMD results



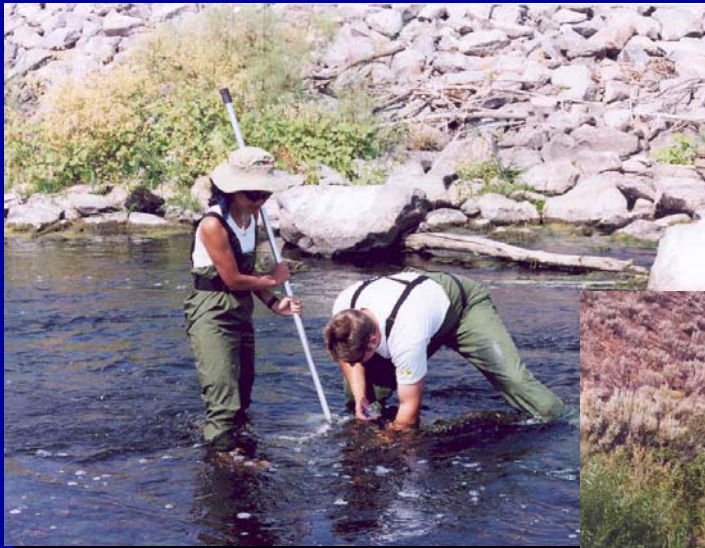


# Mercury synoptic sampling



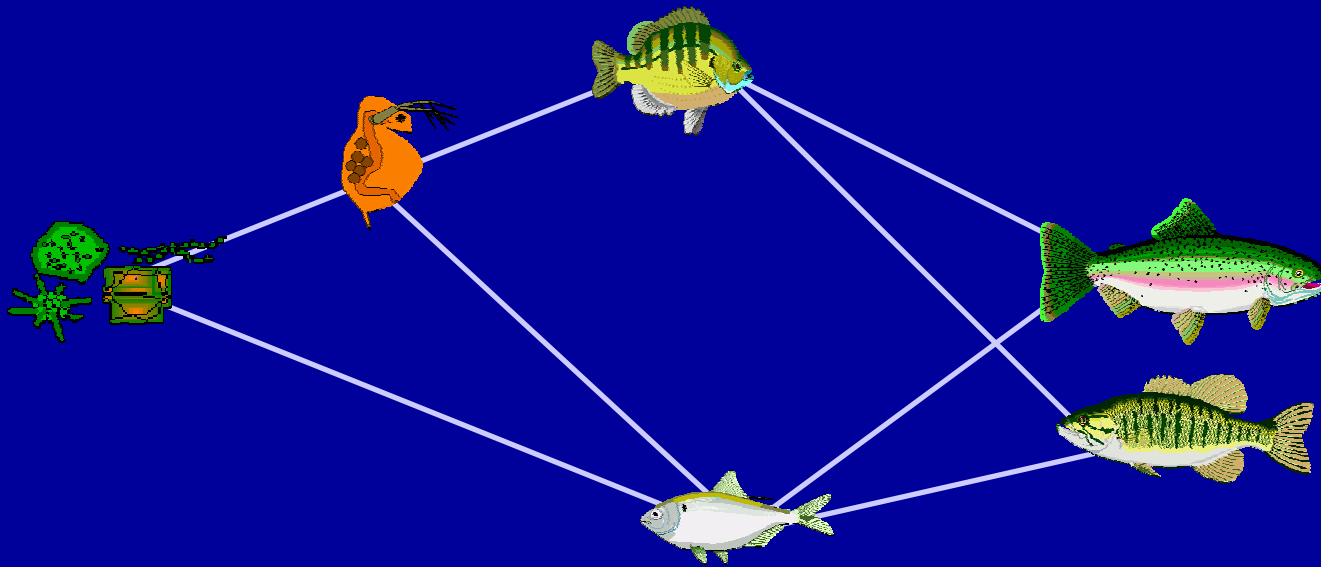
# Recent activities by UNR

- Stable isotope sampling (9 sites)





# Stable isotope analysis



Food web estimation

# Stable isotope analysis

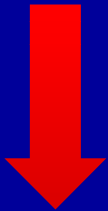
“You are what you eat”



# Stable isotope analysis

Mass spectrometer

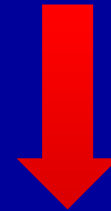
$^{13}\text{C}/^{12}\text{C}$



$\delta^{13}\text{C}$



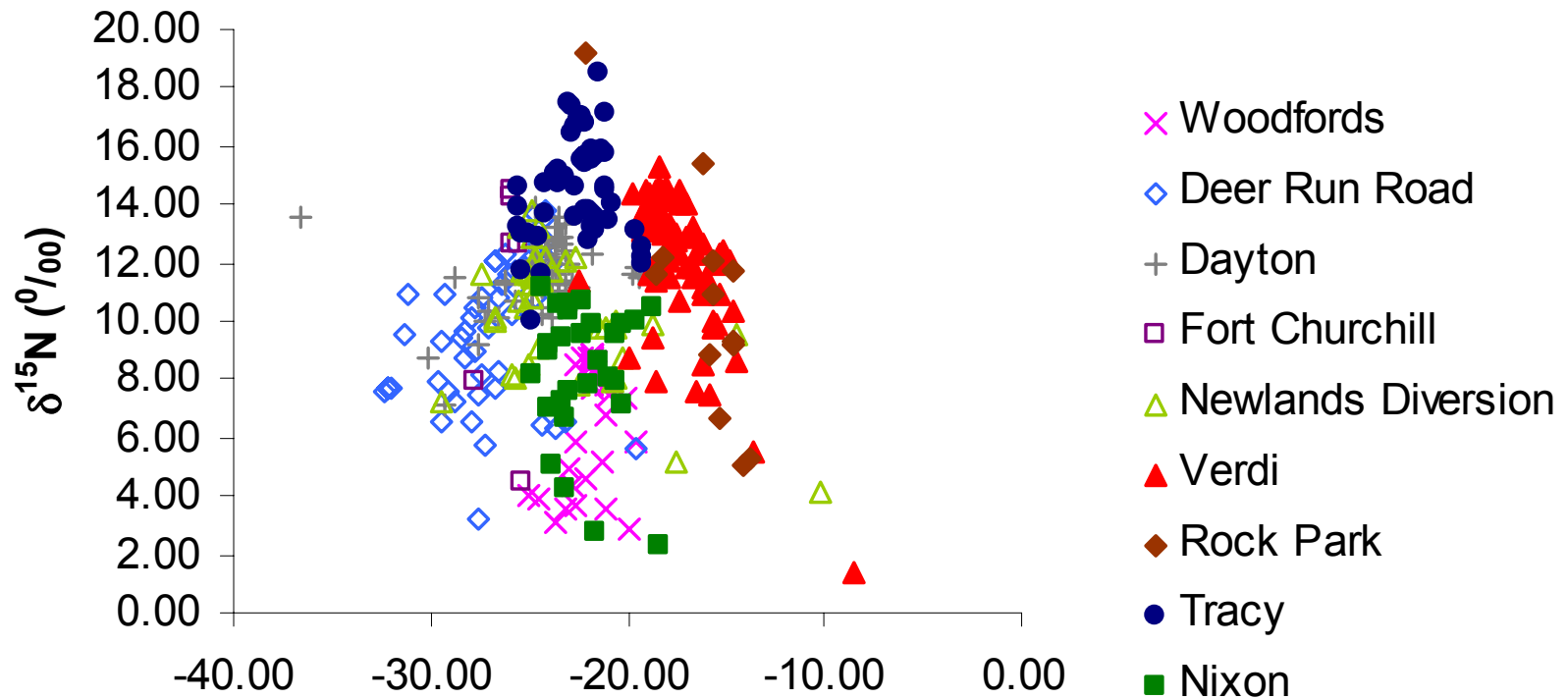
$^{15}\text{N}/^{14}\text{N}$



$\delta^{15}\text{N}$

$$\delta\left(\text{‰}\right) = \frac{R_{sam} - R_{std}}{R_{std}} \times 1000$$

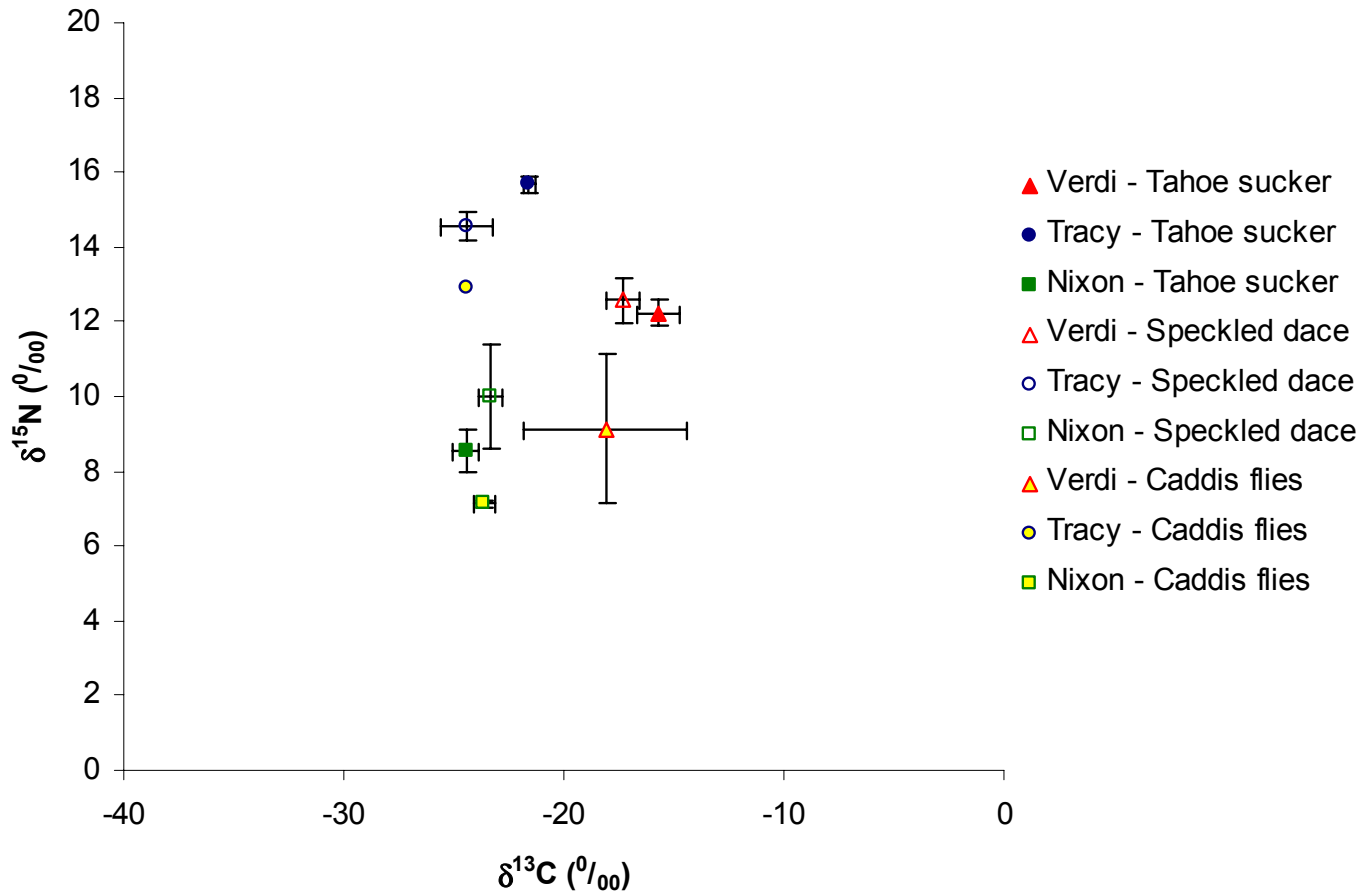
# Stable isotope preliminary results



Truckee River = Solid symbols  
Carson River = Hollow symbols

$\delta^{13}\text{C}$  (‰)

# Stable isotope preliminary results



# Recent activities by PLPT

- Established water quality standards (2001)
- Truckee River
  - Quarterly water quality monitoring
  - Annual bioassessment surveys
  - Development of draft biocriteria standards for the lower Truckee River
- Pyramid Lake
  - Monthly water quality monitoring
- Wetlands
  - Annual bioassessment surveys, water quality monitoring
  - Wetland enhancement projects
- Springs
  - Annual bioassessment and enhancement
- Other projects

# Implications

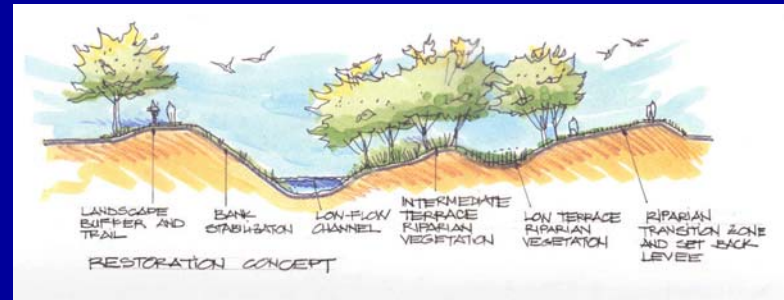
- Dilution effect on river toxicity
- Groundwater/return flow impacts on lower Truckee River in low flow years
- Impacts of cyanobacteria
- Importance of terrestrial-aquatic interactions

# Where do we go from here?

- Channel restoration



McCarran Ranch



Truckee River Community  
Coalition Concept Plan  
(2001)



# Where do we go from here?

- Bioassessment criteria
  - Biological human disturbance gradient application
  - Stable isotope monitoring/modeling?
  - SPMDs

# Where do we go from here?

- Connections

- Carol Kendall, *USGS – Menlo Park*
- Gilbert Cabana, *University of Quebec*
- Chris Fritsen, *Desert Research Institute*
- John Warwick, *Desert Research Institute*
- Steve Goodbred, *USGS – Biological Res. Div.*
- Randall Gray, *Truckee Meadows Water Reclamation Facility*
- Karen Vargas, *NV Dept. of Env. Protection*

# Where do we go from here?

- Other projects/proposals
  - Preliminary samples in spring
  - Rangeland initiative proposal for stable isotope modeling
  - Bigger picture proposals?
    - NSF – Hydrologic impacts on Truckee River food web (Saito)
    - NSF – Biocomplexity of anthropogenic vs. natural disturbance (Fritsen)
    - Human disturbance gradient (Mosley/Rosen)



**For Additional Information  
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